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# **AdafruitRGB***DisplayLibraryDocumentation*

## ***Release 1.0***

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Port of display drivers from <https://github.com/adafruit/micropython-adafruit-rgb-display> to Adafruit CircuitPython for use on Adafruit's SAMD21-based and other CircuitPython boards.

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**Note:** This driver currently won't work on micropython.org firmware, instead you want the micropython-adafruit-rgb-display driver linked above!

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This CircuitPython driver currently supports displays that use the following display-driver chips: HX8353, HX8357, ILI9341, S6D02A1, ST7789, SSD1331, SSD1351, and ST7735 (including variants ST7735R and ST7735S).



# CHAPTER 1

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## Dependencies

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This driver depends on:

- [Adafruit CircuitPython](#)
- [Bus Device](#)

Please ensure all dependencies are available on the CircuitPython filesystem. This is easily achieved by downloading [the Adafruit library and driver bundle](#).

For improved performance consider installing [numpy](#).





## CHAPTER 2

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### Installing from PyPI

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On supported GNU/Linux systems like the Raspberry Pi, you can install the driver locally [from PyPI](#). To install for current user:

```
pip3 install adafruit-circuitpython-rgb-display
```

To install system-wide (this may be required in some cases):

```
sudo pip3 install adafruit-circuitpython-rgb-display
```

To install in a virtual environment in your current project:

```
mkdir project-name && cd project-name
python3 -m venv .env
source .env/bin/activate
pip3 install adafruit-circuitpython-rgb-display
```



## CHAPTER 3

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### Usage Example

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#### 3.1 2.2", 2.4", 2.8", 3.2" TFT

```
import time
import busio
import digitalio
from board import SCK, MOSI, MISO, D2, D3

from adafruit_rgb_display import color565
import adafruit_rgb_display.ili9341 as ili9341

# Configuration for CS and DC pins:
CS_PIN = D2
DC_PIN = D3

# Setup SPI bus using hardware SPI:
spi = busio.SPI(clock=SCK, MOSI=MOSI, MISO=MISO)

# Create the ILI9341 display:
display = ili9341.ILI9341(spi, cs=digitalio.DigitalInOut(CS_PIN),
                          dc=digitalio.DigitalInOut(DC_PIN))

# Main loop:
while True:
    # Clear the display
    display.fill(0)
    # Draw a red pixel in the center.
    display.pixel(120, 160, color565(255, 0, 0))
    # Pause 2 seconds.
    time.sleep(2)
    # Clear the screen blue.
    display.fill(color565(0, 0, 255))
    # Pause 2 seconds.
```

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```
time.sleep(2)
```

## 3.2 1.14" TFT with Raspberry Pi 4

With 1.14" wiring, here is the working code:

```
import time
import busio
import digitalio
from board import SCK, MOSI, MISO, CE0, D24, D25

from adafruit_rgb_display import color565
from adafruit_rgb_display.st7789 import ST7789

# Configuration for CS and DC pins:
CS_PIN = CE0
DC_PIN = D25
RESET_PIN = D24
BAUDRATE = 24000000

# Setup SPI bus using hardware SPI:
spi = busio.SPI(clock=SCK, MOSI=MOSI, MISO=MISO)

# Create the ST7789 display:
display = ST7789(
    spi,
    rotation=90,
    width=135,
    height=240,
    x_offset=53,
    y_offset=40,
    baudrate=BAUDRATE,
    cs=digitalio.DigitalInOut(CS_PIN),
    dc=digitalio.DigitalInOut(DC_PIN),
    rst=digitalio.DigitalInOut(RESET_PIN))

# Main loop: same as above
while True:
    # Clear the display
    display.fill(0)
    # Draw a red pixel in the center.
    display.pixel(120, 160, color565(255, 0, 0))
    # Pause 2 seconds.
    time.sleep(2)
    # Clear the screen blue.
    display.fill(color565(0, 0, 255))
    # Pause 2 seconds.
    time.sleep(2)
```

## CHAPTER 4

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### Contributing

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Contributions are welcome! Please read our [Code of Conduct](#) before contributing to help this project stay welcoming.



## CHAPTER 5

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### Documentation

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For information on building library documentation, please check out [this guide](#).





## 6.1 Simple test

Ensure your device works with this simple test.

Listing 1: examples/rgb\_display\_simpletest.py

```
1  # Quick test of TFT FeatherWing (ST7789) with Feather M0 or M4
2  # This will work even on a device running displayio
3  # Will fill the TFT black and put a red pixel in the center, wait 2 seconds,
4  # then fill the screen blue (with no pixel), wait 2 seconds, and repeat.
5  import time
6  import random
7  import digitalio
8  import board
9  import displayio
10
11  from adafruit_rgb_display.rgb import color565
12  import adafruit_rgb_display.st7789 as st7789
13
14  displayio.release_displays()
15
16  # Configuratin for CS and DC pins (these are FeatherWing defaults on M0/M4):
17  cs_pin = digitalio.DigitalInOut(board.D5)
18  dc_pin = digitalio.DigitalInOut(board.D6)
19  reset_pin = digitalio.DigitalInOut(board.D9)
20
21  # Config for display baudrate (default max is 24mhz):
22  BAUDRATE = 24000000
23
24  # Setup SPI bus using hardware SPI:
25  spi = board.SPI()
26
27  # Create the ST7789 display:
```

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```

28 display = st7789.ST7789(spi, cs=cs_pin, dc=dc_pin, rst=reset_pin, baudrate=BAUDRATE)
29
30 # Main loop:
31 while True:
32     # Fill the screen red, green, blue, then black:
33     for color in ((255, 0, 0), (0, 255, 0), (0, 0, 255)):
34         display.fill(color565(color))
35     # Clear the display
36     display.fill(0)
37     # Draw a red pixel in the center.
38     display.pixel(display.width // 2, display.height // 2, color565(255, 0, 0))
39     # Pause 2 seconds.
40     time.sleep(2)
41     # Clear the screen a random color
42     display.fill(
43         color565(random.randint(0, 255), random.randint(0, 255), random.randint(0,
44         ↪255))
45     )
46     # Pause 2 seconds.
47     time.sleep(2)

```

Listing 2: examples/rgb\_display\_ili9341test.py

```

1  # Quick test of TFT FeatherWing (ILI9341) with Feather M0 or M4
2  # Will fill the TFT black and put a red pixel in the center, wait 2 seconds,
3  # then fill the screen blue (with no pixel), wait 2 seconds, and repeat.
4  import time
5  import random
6  import busio
7  import digitalio
8  import board
9
10 from adafruit_rgb_display.rgb import color565
11 import adafruit_rgb_display.ili9341 as ili9341
12
13
14 # Configuratin for CS and DC pins (these are FeatherWing defaults on M0/M4):
15 cs_pin = digitalio.DigitalInOut(board.D9)
16 dc_pin = digitalio.DigitalInOut(board.D10)
17
18 # Config for display baudrate (default max is 24mhz):
19 BAUDRATE = 24000000
20
21 # Setup SPI bus using hardware SPI:
22 spi = busio.SPI(clock=board.SCK, MOSI=board.MOSI, MISO=board.MISO)
23
24 # Create the ILI9341 display:
25 display = ili9341.ILI9341(spi, cs=cs_pin, dc=dc_pin, baudrate=BAUDRATE)
26
27 # Main loop:
28 while True:
29     # Fill the screen red, green, blue, then black:
30     for color in ((255, 0, 0), (0, 255, 0), (0, 0, 255)):
31         display.fill(color565(color))
32     # Clear the display
33     display.fill(0)

```

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```

34  # Draw a red pixel in the center.
35  display.pixel(display.width // 2, display.height // 2, color565(255, 0, 0))
36  # Pause 2 seconds.
37  time.sleep(2)
38  # Clear the screen a random color
39  display.fill(
40      color565(random.randint(0, 255), random.randint(0, 255), random.randint(0,
↪255))
41  )
42  # Pause 2 seconds.
43  time.sleep(2)

```

## 6.2 adafruit\_rgb\_display.rgb

Base class for all RGB Display devices

- Author(s): Radomir Dopieralski, Michael McWethy

**class** adafruit\_rgb\_display.rgb.**Display**(width, height, rotation)

Base class for all RGB display devices :param width: number of pixels wide :param height: number of pixels high

**fill** (color=0)

Fill the whole display with the specified color.

**fill\_rectangle** (x, y, width, height, color)

Draw a rectangle at specified position with specified width and height, and fill it with the specified color.

**hline** (x, y, width, color)

Draw a horizontal line.

**image** (img, rotation=None, x=0, y=0)

Set buffer to value of Python Imaging Library image. The image should be in 1 bit mode and a size not exceeding the display size when drawn at the supplied origin.

**init** ()

Run the initialization commands.

**pixel** (x, y, color=None)

Read or write a pixel at a given position.

**rotation**

Set the default rotation

**vline** (x, y, height, color)

Draw a vertical line.

**class** adafruit\_rgb\_display.rgb.**DisplaySPI**(spi, dc, cs, rst=None, width=1, height=1, baudrate=12000000, polarity=0, phase=0, \*, x\_offset=0, y\_offset=0, rotation=0)

Base class for SPI type devices

**read** (command=None, count=0)

SPI read from device with optional command

**reset** ()

Reset the device

**write** (*command=None, data=None*)  
SPI write to the device: commands and data

**class** adafruit\_rgb\_display.rgb.DummyPin  
Can be used in place of a `DigitalInOut()` when you don't want to skip it.

**deinit** ()  
Dummy `DigitalInOut` deinit

**direction**  
Dummy `direction` `DigitalInOut` property

**pull**  
Dummy `pull` `DigitalInOut` property

**switch\_to\_input** (\*args, \*\*kwargs)  
Dummy `switch_to_input` method

**switch\_to\_output** (\*args, \*\*kwargs)  
Dummy `switch_to_output` method

**value**  
Dummy `value` `DigitalInOut` property

adafruit\_rgb\_display.rgb.color565 (*r, g=0, b=0*)  
Convert red, green and blue values (0-255) into a 16-bit 565 encoding. As a convenience this is also available in the parent `adafruit_rgb_display` package namespace.

adafruit\_rgb\_display.rgb.image\_to\_data (*image*)  
Generator function to convert a PIL image to 16-bit 565 RGB bytes.

## 6.3 adafruit\_rgb\_display.hx8353

A simple driver for the HX8353-based displays.

- Author(s): Radomir Dopieralski, Michael McWethy

**class** adafruit\_rgb\_display.hx8353.HX8353 (*spi, dc, cs, rst=None, width=128, height=128, rotation=0*)

A simple driver for the HX8353-based displays.

```
>>> import busio
>>> import digitalio
>>> import board
>>> from adafruit_rgb_display import color565
>>> import adafruit_rgb_display.hx8353 as hx8353
>>> spi = busio.SPI(clock=board.SCK, MOSI=board.MOSI, MISO=board.MISO)
>>> display = hx8353.HX8353(spi, cs=digitalio.DigitalInOut(board.GPIO0),
...     dc=digitalio.DigitalInOut(board.GPIO15))
>>> display.fill(0x7521)
>>> display.pixel(64, 64, 0)
```

## 6.4 adafruit\_rgb\_display.ili9341

A simple driver for the ILI9341/ILI9340-based displays.

- Author(s): Radomir Dopieralski, Michael McWethy

```
class adafruit_rgb_display.ili9341.ILI9341 (spi, dc, cs, rst=None, width=240, height=320,  
baudrate=16000000, polarity=0, phase=0, ro-  
tation=0)
```

A simple driver for the ILI9341/ILI9340-based displays.

```
>>> import busio
>>> import digitalio
>>> import board
>>> from adafruit_rgb_display import color565
>>> import adafruit_rgb_display.ili9341 as ili9341
>>> spi = busio.SPI(clock=board.SCK, MOSI=board.MOSI, MISO=board.MISO)
>>> display = ili9341.ILI9341(spi, cs=digitalio.DigitalInOut(board.GPIO0),
...     dc=digitalio.DigitalInOut(board.GPIO15))
>>> display.fill(color565(0xff, 0x11, 0x22))
>>> display.pixel(120, 160, 0)
```

```
scroll (dy=None)
```

Scroll the display by delta y

## 6.5 adafruit\_rgb\_display.s6d02a1

A simple driver for the S6D02A1-based displays.

- Author(s): Radomir Dopieralski, Michael McWethy

```
class adafruit_rgb_display.s6d02a1.S6D02A1 (spi, dc, cs, rst=None, width=128, height=160,  
rotation=0)
```

A simple driver for the S6D02A1-based displays.

```
>>> import busio
>>> import digitalio
>>> import board
>>> from adafruit_rgb_display import color565
>>> import adafruit_rgb_display.s6d02a1 as s6d02a1
>>> spi = busio.SPI(clock=board.SCK, MOSI=board.MOSI, MISO=board.MISO)
>>> display = s6d02a1.S6D02A1(spi, cs=digitalio.DigitalInOut(board.GPIO0),
...     dc=digitalio.DigitalInOut(board.GPIO15), rst=digitalio.DigitalInOut(board.
→GPIO16))
>>> display.fill(0x7521)
>>> display.pixel(64, 64, 0)
```

## 6.6 adafruit\_rgb\_display.ssd1331

A simple driver for the SSD1331-based displays.

- Author(s): Radomir Dopieralski, Michael McWethy

```
class adafruit_rgb_display.ssd1331.SSD1331 (spi, dc, cs, rst=None, width=96, height=64,  
baudrate=16000000, polarity=0, phase=0, *,  
rotation=0)
```

A simple driver for the SSD1331-based displays.

```
import busio
import digitalio
import board
```

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```

from adafruit_rgb_display import color565
import adafruit_rgb_display.ssd1331 as ssd1331
spi = busio.SPI(clock=board.SCK, MOSI=board.MOSI, MISO=board.MISO)
display = ssd1331.SSD1331(spi, cs=digitalio.DigitalInOut(board.GPIO0),
                        dc=digitalio.DigitalInOut(board.GPIO15),
                        rst=digitalio.DigitalInOut(board.GPIO16))

display.fill(0x7521)
display.pixel(32, 32, 0)

```

**write** (*command=None, data=None*)  
 write procedure specific to SSD1331

## 6.7 adafruit\_rgb\_display.ssd1351

A simple driver for the SSD1351-based displays.

- Author(s): Radomir Dopieralski, Michael McWethy

**class** adafruit\_rgb\_display.ssd1351.**SSD1351** (*spi, dc, cs, rst=None, width=128, height=128, baudrate=16000000, polarity=0, phase=0, \*, x\_offset=0, y\_offset=0, rotation=0*)

A simple driver for the SSD1351-based displays.

```

>>> import busio
>>> import digitalio
>>> import board
>>> from adafruit_rgb_display import color565
>>> import adafruit_rgb_display.ssd1351 as ssd1351
>>> spi = busio.SPI(clock=board.SCK, MOSI=board.MOSI, MISO=board.MISO)
>>> display = ssd1351.SSD1351(spi, cs=digitalio.DigitalInOut(board.GPIO0),
...     dc=digitalio.DigitalInOut(board.GPIO15), rst=digitalio.DigitalInOut(board.
↳ GPIO16))
>>> display.fill(0x7521)
>>> display.pixel(32, 32, 0)

```

## 6.8 adafruit\_rgb\_display.st7735

A simple driver for the ST7735-based displays.

- Author(s): Radomir Dopieralski, Michael McWethy

**class** adafruit\_rgb\_display.st7735.**ST7735** (*spi, dc, cs, rst=None, width=128, height=128, baudrate=16000000, polarity=0, phase=0, \*, x\_offset=0, y\_offset=0, rotation=0*)

A simple driver for the ST7735-based displays.

```

>>> import busio
>>> import digitalio
>>> import board
>>> from adafruit_rgb_display import color565
>>> import adafruit_rgb_display.st7735 as st7735
>>> spi = busio.SPI(clock=board.SCK, MOSI=board.MOSI, MISO=board.MISO)

```

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```
>>> display = st7735.ST7735(spi, cs=digitalio.DigitalInOut(board.GPIO0),
...     dc=digitalio.DigitalInOut(board.GPIO15), rst=digitalio.DigitalInOut(board.
↳GPIO16))
>>> display.fill(0x7521)
>>> display.pixel(64, 64, 0)
```

```
class adafruit_rgb_display.st7735.ST7735R(spi, dc, cs, rst=None, width=128, height=160,
                                         baudrate=16000000, polarity=0, phase=0, *,
                                         x_offset=0, y_offset=0, rotation=0, bgr=False)
```

A simple driver for the ST7735R-based displays.

```
init()
```

Run the initialization commands.

```
class adafruit_rgb_display.st7735.ST7735S(spi, dc, cs, bl, rst=None, width=128,
                                         height=160, baudrate=16000000, polar-
                                         ity=0, phase=0, *, x_offset=2, y_offset=1,
                                         rotation=0)
```

A simple driver for the ST7735S-based displays.





## CHAPTER 7

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